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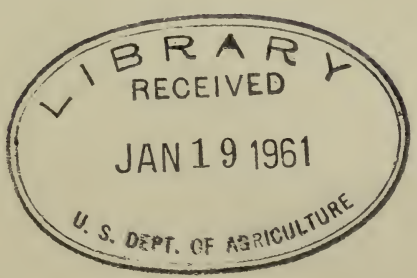

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FOREST INSECT AND DISEASE CONDITIONS IN THE NORTHEAST -- 1959

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MAJOR FOREST INSECTS

Copious foliage production was favored this year by weather and climatic conditions from the spruce and fir of northern Maine to the pine and oak forests of the more southerly reaches of the Northeast. Continued depredations on the region's forests were made by such familiar pests as the spruce budworm, white-pine weevil, and the shoot and tip moths. Outbreaks also occurred of some of the more sporadic insects--the eastern and forest tent caterpillars, the red-humped oak worm, and the pine sawflies.

The 1958-59 winter was rather severe; deep frosts killed and damaged coniferous ornamentals and shrubs in New England, New York, and Pennsylvania. Winter mortality of exposed insects was reported from locations throughout the region. April and May were cool and dry in northern Maine, while over most of the region May, June, and July brought rainfall. Hot and humid weather prevailed throughout August and September inland through Maryland and most of Pennsylvania, but the northeastern corner of Pennsylvania, eastern New York, New Jersey, and coastal Maryland experienced drought conditions. Localized tree mortality, especially on dry ridges, occurred where current defoliators furthered the effects of previous feeding. In many localities, secondary insects were more abundant than last year.

Research continues on many basic problems in the behavior and population dynamics of our major pests. A thorough understanding of the ecology of these destructive forest insects and the biological and physical realm in which they live and do damage is essential in ultimately developing preventive and suppressive methods to control them. More knowledge of their relations and effects on host trees is needed to define tolerable population levels.

Spruce Budworm

The budworm population in the 1958 control area in northern Maine was drastically reduced, and lush new growth appeared in the crowns beneath which could be seen the brown of previous defoliation. Systematic

surveys had revealed that larval and egg parasitism was high, so the outlook for 1959 was good enough that control action was not deemed necessary.

As forecast by the 1958 egg mass survey, however, medium to heavy populations of the budworm were found in a band along the western and southwestern periphery of the control area. Further evidence of this residual infestation was given by the aerial line strip survey, which was flown from Fort Kent southward to Oak Hill Mountain and Grand Lake Seboois.

Moderate and heavy feeding was observed from Hedgehog Mountain south to Ashland and from Portage Lake to Ferguson and Carr Ponds. Another area of heavy feeding was detected between Squapan Mountain and Presque Isle Stream. About 105,000 acres were encompassed by this moderate-to-heavy feeding and an additional 840,000 acres surrounding these areas and extending northward and eastward to Van Buren contained light to trace feeding in discontinuous patches.

The program of moth, larval, and egg collections for evaluation of budworm populations and parasites continued this year with emphasis on the egg-mass survey. Material was examined and reared at the Portage Lake laboratory and at Augusta. Studies of the effects of spraying on fauna of streams and lakes were carried into the second year at Sinclair. Results of this study indicate sudden reduction of some stream insects immediately following the application of insecticide, with all forms returning to approximate pretreatment numbers by the second year.

The western edge of the infestation in northern Maine has been remarkably stable, suggesting a strong influence of prevailing westerly winds on moth movement. Moth dispersal has been eastward for several years, and it was the case again this year when egg deposition increased to medium-heavy up to five miles into the spray area. Greater numbers of budworms can thus be expected next year in the 1958 control area. Lush fir growth and favorable weather conditions resulted in rapid development of the larvae this year, and parasitism was lower than expected.

Increment cores taken in areas of severe feeding

showed a definite decline in growth relative to other tree species in the areas. Further defoliation can be expected to produce greater loss of vigor and top-killing where foliage is already thin. Entomologists of the Maine Forest Service and the New Haven Forest Insect Laboratory have recommended that approximately 175,000 acres be treated by airplane in 1960.

Balsam
Woolly Aphid

The balsam woolly aphid was introduced into this continent from Europe and spread into the Northeast, probably before 1900. Since then it has become generally distributed throughout balsam fir stands in Maine, Vermont, New Hampshire, Massachusetts, and in the Adirondacks of New York State. It was recognized as the cause of the death and decline of fir in the Canadian Maritimes by 1930, and since then it has become increasingly evident in the Green and White Mountains, in coastal and inland stands in Maine, and in the Adirondacks. A large percentage of fir in those areas is currently infested--in the Green Mountains as much as 75 percent of the merchantable volume of some stands.

Inland the damage is chiefly due to stem attack in which the trees show fading, reddening, loss of foliage accompanied by loss in growth and vigor and, in heavy infestation, finally death. Along the Maine coastal areas in Washington and Hancock Counties, the damage is the characteristic "gouting" resulting from attack on the upper branches and twigs. Dead tops and poorly formed trees prevail, and merchantability is so low that many landowners there have come to regard balsam fir as a weed species.

Long range studies in the Penobscot Experimental Forest are threatened by continuing infestation in the management compartments. Here both stem and gout attack are found with consequent tree deterioration and mortality. Biological control of the aphid on the Forest is now in progress, through release of a beetle which preys upon it in Europe. This beetle, Laricobius erichsonii, has been established locally in New Brunswick, where it was first released on this continent, as well as in Vermont, New Hampshire, and the Pacific Northwest. Funds and collecting facilities were made available for this

release by the A. R. S. and the Commonwealth Institute of Biological Control (Canada). Approximately 16,000 beetles, 100 each on a number of heavily infested trees in two compartments, were released this year. It will be at least two years before the results can be fully evaluated, but the beetles have become established.

In addition, 1,140 adults of the dipterous predator Aphidoletes thompsoni, collected as pupae in West Germany, have been released at three locations on the Experimental Forest. Another imported dipterous predator, Neoleucopis obscura, is already established there and elsewhere in New England.

A reliable, economical, and rapid method of surveying the extent and degree of infestation of this pest is much needed. An experiment to determine the feasibility of color aerial photography for detecting and assessing damage was initiated in October by the Beltsville Forest Insect Laboratory and the New Haven Laboratory in cooperation with the Maine Forest Service and the Vermont Department of Forests and Parks. Twelve plots were established, three in the Penobscot Experimental Forest, six in Hancock County, Maine, and three in Vermont. Vertical and oblique photos at several scales were taken with a new type 70 mm. camera that permits continuous strip, low-level photography. Analysis of the ground data and the photo interpretations are now in progress.

More research is much needed on how the physical factors of environment affect the behavior and survival of this insect.

Pine
Sawflies

Sawflies of the Neodiprion pratti complex defoliated extensive areas in Delaware, Maryland, and New Jersey again, and surveys of the current populations and the naturally occurring mortality factors have continued. The area of infestation by the pitch pine sawfly, N. pratti paradoxicus, in New Jersey encompassed 2,343 sq. mi. It also occurs on shortleaf pine, but to a lesser extent than on the pitch pine. Although some local spots of severe defoliation were noted, over the area as a whole, defoliation has followed the declining trend

observed in 1957 and 1958. Some parasites and predators which are known to be natural control agents of this sawfly are very abundant in the areas of infestation. No systematic recovery survey has been made for the 1.5 million Dahlbominus fuscipennis reared and released there since 1957 by the New Jersey Division of Plant Industry, but it has been recovered at various points and is probably well established.

The Virginia pine sawfly, N. pratti pratti, has also done less damage, but it is still generally distributed throughout Maryland and Delaware, with large blocks of defoliation adjacent to areas of light or no defoliation. Studies of the virus disease of the Virginia pine sawfly were continued this year in cooperation with the Insect Pathology Laboratory, A. R. S.

The European pine sawfly, N. sertifer, caused serious defoliation in southern Connecticut, southern New York, northeastern Pennsylvania, and northern New Jersey. About 250 acres were sprayed in Pennsylvania by the Pennsylvania Department of Forests and Waters with a virus spray furnished by the New Haven Laboratory. Control was reported as very satisfactory. Another virus spray furnished a Christmas-tree grower in Connecticut also provided good results. Diseased larvae from both of the applications have been collected for stocking at New Haven.

The sawfly discovered infesting pitch pine in New Jersey in 1958 has been identified by Dr. H. H. Ross for the New Jersey Division of Plant Industry as Neodiprion pini-rigidae; it shows every indication of developing into a serious outbreak in southern New Jersey. Last instar larvae and cocoons were found in company with colonies of small larvae late in June; apparently there are two generations per year. The larvae will feed on both new and old foliage. The parasites which are currently bringing N. pratti paradoxicus under control in the area may not be effective against N. pini-rigidae because the latter displays such rapid development that its periods of vulnerability are quite short, and its development does not appear to coincide with the peaks of parasite abundance. Thus far it has been found over an area of about 1,000 sq. mi.

The red-headed pine sawfly, N. lecontei, was

generally abundant in 1959. It was heaviest in New York State on red pine, and did moderate damage to white pine in Delaware. It was reported from Pennsylvania and from Maryland where it caused heavy damage to a small area of Austrian pine on Catoctin Mountain near Frederick. The red-pine sawfly, N. nanulus, was at a lower level this year than last, and the numbers have been declining steadily since 1957 when it was serious locally in northern New York on red pine. N. taedae was present in Maryland and Delaware but defoliation was generally light.

Shoot and
Tip Moths

These pests are mong the insects which, like the white-pine weevil, perennially infest plantations and reforestation plantings; they have been with us for years in relatively stable numbers but sufficient to exact great losses in valuable growth and in form. The European pine shoot moth, Rhyacionia buoliana, the primary insect enemy of red pine, is particularly damaging in the tree's first ten years of growth. Scotch pine is another favored host. Control is still expensive and confined to small-scale methods, such as hand clipping of infested tips and limited application of heavy doses of toxicants.

It was again a major problem on Maryland's lower Eastern Shore, and it has infested plantations in eastern Maryland. Valuable red and Scotch pine plantations were damaged in West Virginia this year. Larvae were observed in the second week of May in Fayette and Lancaster Counties, Pennsylvania. It was pupating by June 9 in Pennsylvania, and adults were 50 to 75 percent emerged by June 15 in Maryland. It was reported from southeastern Connecticut and New York State.

The Nantucket pine tip moth, R. frustrana, was reported on loblolly pine in various locations on the Eastern Shore and throughout eastern Maryland. It also damaged Scotch and red pines at several locations in Pennsylvania. This pest presents a particularly difficult control problem because of its two generations a year in the Middle Atlantic area.

Moths of the genus Eucosma were continuously

reported causing injury to tips and laterals of red, white, and Scotch pines in the region.

Pine Leaf Aphid

Rather intense observation has been directed toward this pest in recent years, especially in eastern Maine and Vermont where injury to white pine has become more serious. Larger trees are reportedly being affected more than previously reported and the cumulative effects of growth loss due to twig damage are becoming increasingly apparent. Small-scale tests of various insecticides have been conducted by the Vermont Department of Forests and Parks. The aphid also appeared at spots in New York State as it has for years.

Miscellaneous Insects On Conifers

Reports from throughout the Northeast indicate that the white-pine weevil, Pissodes strobi, was again abundant and remains the most serious deterrent to production of quality white pine. The pine spittlebug, Aphrophora parallela, was light throughout New York but heavy on white pines in Essex and Clinton Counties; in Delaware it was moderately heavy on Virginia and loblolly pines; light but extensive in Maryland; and heavy on Virginia and Scotch pines in West Virginia.

Spruce gall aphid, Chermes abietis, was generally common and locally heavy in Maine; it appears to have increased in the lower Hudson Valley in New York and was reported from both Maryland and Pennsylvania. The Cooley spruce gall aphid, C. cooleyi, was locally quite heavy in New York. Cinara (probably banksianae) aphids were common in Pennsylvania on Virginia pine.

The pine needle scale, Phenacaspis pinifoliae, was reported lightly infesting a 54-year-old white pine plantation in Clinton County, and a foxtail pine planting in Schroon, N. Y., and is exceedingly heavy in a local infestation near Burlington, Vt., on white, Scotch, and mugho pines.

The pine needle miner, Exoteleia pinifoliella, was locally heavier than usual this year. In southern

New Jersey there were spots of severe feeding on pitch pine, a heavy infestation in the Miles Standish State Park of Massachusetts, and on Virginia pine in Kent and New Castle Counties, Delaware.

The pales weevil, Hylobius pales, fed heavily in some Christmas tree plantings in Pennsylvania. Adults deposited eggs in early May on pine and fir stumps from 1958 cuttings in Franklin and Adams Counties. New York had Scotch and white pine Christmas trees heavily damaged. The root collar weevil, Hylobius radicis, has infested three plantations totalling about 18 acres of red and Scotch pines in Warren and Saratoga Counties, New York, and is reported killing some red pines in Lewis County. It has practically ruined a Christmas tree planting of Scotch pine at Shelton, Conn.

A new spot infestation of the red pine scale, Matsucoccus resinosae, has been discovered east of the Housatonic River in Milford, Conn., extending its known distribution across the river for the first time since its discovery in 1946. Matsucoccus gallicolus, the pine twig gall scale, is commonly killing pitch pine tips in the Mount Holly-Pine Grove Furnace area of Pennsylvania.

The larch sawfly, Pristiphora erichsonii, was reported increasing in Maine. In Pennsylvania it defoliated Japanese larch plantings near Emporium and at Renovo where this was the sixth year of observed defoliation.

Forest Tent Caterpillar

The forest tent caterpillar has probably the greatest range of any hardwood defoliator in this region and appears more or less regularly in outbreaks that last from about three to five years.

The infestations in West Virginia, Maryland, and Pennsylvania which appeared on the increase last year showed varying trends this year. Some continued at a high level, others declined sharply. About 18,000 acres near Witcher's Creek, W. Va., were stripped this year, and approximately 14,000 acres more were severely defoliated throughout Tucker, Hampshire, Monongalia, and Hardy Counties. The larvae fed on various oaks, mostly on

the scarlet and red, and on sugar maple, black cherry, hickory, and black gum. Red maple, characteristically, was left untouched.

In southern Pennsylvania light populations of 1958 developed in extent and numbers especially in the Confluence area. Damage occurred also in Somerset, Fayette, and Franklin Counties. Spots in western Maryland had heavy defoliation.

Outbreaks of this gregarious feeder generally succumb to the natural control factors of disease and parasites. The principal parasite, Sarcophaga aldrichi Park, was abundant this year. In Somerset and Fayette Counties, Pennsylvania, the tent caterpillar populations were hit hard by wilt disease, and dead larvae were seen in mats of thousands on the trunks of sugar maples and oaks. Therefore, cocooning was very light here where the disease was prevalent. However, in other areas of Pennsylvania and in West Virginia egg masses were plentiful and serious damage may occur again.

Several experimental units have been set up in the Greenwood Furnace-Boiling Springs area of Pennsylvania for field testing of a virus spray against the forest tent caterpillar. The virus will be applied by airplane at the rate of 85 billion polyhedra in two gallons of water per acre. This is a joint undertaking of the Forest Service, A. R. S., and the Pennsylvania Department of Forests and Waters to determine whether control by this means is feasible.

Gypsy Moth

A season of favorable weather and plentiful foliage found increases in infestation of the gypsy moth in some locations throughout eastern New York, Massachusetts, and Connecticut. Some winter kill of eggs above snowline in Vermont was observed but no larvae were reported killed by early spring frost. The defoliation in New York and New England is summarized from information received from the Plant Pest Control Division, A. R. S., in the table on the next page.

	Acres
Maine, York County	1,000
New Hampshire --	
Merrimack River Valley	2,000
Walpole, Langdon	2,000
Vermont -- Champlain Valley	1,500
Massachusetts	382
Connecticut	5,980
New York	1,605
Total	14,467

Approximately 5,400 acres in 15 Connecticut towns were less than half defoliated, and 670 acres more than half. About 7,000 acres in 10 towns were sprayed by local agencies. In New York, a Sevin-paraffin-oil suspension was used on more than 80,000 acres in Otsego and northeastern Delaware Counties in a cooperative undertaking by the New York State Department of Agriculture and Markets, the New York Conservation Department, the New York College of Agriculture, and the Plant Pest Control Division of A. R. S. Control treatments with DDT were made by cooperating state and town agencies in Massachusetts and Vermont.

Orange-striped
Oak Worm

As is characteristic of this sporadic oak defoliator, there were localized but severe spot infestations this year--in Rhode Island, Connecticut, south-central Pennsylvania, northern Maryland, and eastern New York. Still, infestations were generally lighter this year than in 1958. The dropoff was most pronounced in eastern Connecticut, where the red-humped oak worm was more abundant.

In Pennsylvania, near Pine Grove Furnace, some scarlet oaks died this year, following several years' feeding. In Connecticut, the area of serious infestation was about one-tenth that of last year: The Connecticut Agricultural Experiment Station estimated it to be about 4,000 acres.

The larvae of the orange-striped oak worm begin their feeding well into the summer, sometimes as late as the first of September. Thus, much of a tree's growth

is laid down before feeding is completed. Oaks of sapling size or larger can withstand two or more years of rather intensive defoliation. The removal of leaves, of course, causes increment loss, reduced vigor, drying and increased temperature of the soil, and other indirect and cumulative effects.

Miscellaneous Insects on Hardwoods

The beech scale, Cryptococcus fagi, was reported to be about the same as last year in northern New England; in southern New Hampshire it was reported as very abundant but with no Nectria observed. There is a general infestation on beech throughout the Hudson Valley, and a heavy infestation of about five acres extent near Warrensburg, N. Y.

Two oak leaf miners, the solitary, Cameraria hamadryadella, and the gregarious, C. cincinnatiella, browned oak leaves and made trees particularly unattractive in Rhode Island, eastern Massachusetts, generally in Connecticut, and in Orange County, N. Y.--a drastic increase over last year.

The variable oak leaf caterpillar, Heterocampa manteo, was observed over the southern part of the region and seriously defoliated oaks at spots in Maryland. The white-marked tussock moth, Heterocampa leucostigma, lightly defoliated sycamore and elm in Delaware, and was scattered generally over Nantucket Island, Mass. An oak leaf roller, Argyrotoxa semipurpurana, defoliated oaks, especially scarlet, scrub, and red, on ridgetops in Fulton County, Pa., and completely stripped 700 to 1,000 acres in western Massachusetts.

The ugly-nest caterpillar, Archips cerasivorana, was common with local outbreaks on cherry in Massachusetts, indicating a recurrence of the pest at about a 10-year cycle. The large aspen tortrix, A. conflictana, and the fruit tree leaf roller, A. argyrospila, together defoliated about 3,000 acres of aspen in Essex County, N. Y. The satin moth, Stilpnotia salicis, was light to heavy in parts of New York. The yellow-necked caterpillar, Datana ministra, was reported heavy on pin oak in New Castle County, Delaware.

Large numbers of the birch leaf miner, Fenusa pusilla, did unusual damage in New York State, completely killing leaves in some locations. The imported willow leaf beetle, Plagiodera versicolora, skeletonized weeping willows in Massachusetts and willows in general in Rhode Island and Delaware where it was described as heavy. The maple leaf cutter, Paraclemensia acerifoliella, again appeared near Boonville and Carthage, N. Y. The chain-spotted geometer, Cingilia catenaria, injured a variety of hosts in coastal Rhode Island. Membracids were abundant on the foliage of scarlet oaks in Berks County, Pennsylvania. These were reported as Cyrtolobus puritus, Cyrtolobus sp., and Smilia camelus.

MAJOR FOREST DISEASES

Highlights of the disease picture in 1959 were: (1) the severe winter injury suffered by most conifers and many broadleaved ornamentals, particularly where grown in exposed locations; (2) the exceptionally low ebb for most foliage diseases; and (3) the generally lessened damage caused by the rust diseases. The oak wilt situation was about normal, but Dutch elm disease appeared to be an increasing problem over the entire region. Root rot diseases were quite in evidence, particularly those caused by Fomes annosus and Polyporus schweinitzii. Heart rots, cankering diseases, shoot blights, and witches' brooms were normal or quiescent, and none were alarming or particularly abundant. With the exceptions of Rhabdocline and Adelopus needle casts of Douglas-fir and Fomes annosus in pines, nursery and plantation diseases were about normal. Miscellaneous environmental troubles and diseases of unexplained causes were present but less so in 1959 than in either 1957 or 1958.

The disease picture has changed quite often in the past three years, thus reflecting the causal effects of weather conditions and its secondary effects of plant environment. Diseases in 1957 were strongly influenced by the severe and prolonged drought. For example, foliage and rust diseases appeared early and indications were

that they would be severe, but the long drought suppressed their development. Dieback diseases and environmental troubles were especially prominent during 1957.

In 1958, prolonged wet weather during the early growing season promoted favorable conditions for the foliage and rust diseases. Sycamore anthracnose was very prominent, the worst it had been for many years. It is believed that carryover effects of the 1957 drought increased the troubles resulting from root rots. In 1959, tree diseases were generally at a low level, as indicated above.

A brief review of the weather for 1959 gives a better understanding of the general disease situation during the past season. The winter was very cold over most of the Northeast and soils were frozen deep and hard practically all winter. Intermittent winter thaws were few and of short duration, and soil moisture remained frozen. As a result, winter drying was severe over the whole Northeast and winter damage extensive, involving many conifers and evergreen broadleaves. Larger trees and plants with deep root systems were not hit so hard, although some of the smaller-sized conifers were severely injured. Exposure conditions play an important part in this sort of injury.

An abrupt change occurred about the first of May and fairly good growing conditions prevailed. The first half of May had ample rains and temperatures were suitable for the first spurt of growth in the spring, although it was about a week later than usual. The latter half of May became somewhat dry, but the month of June, although cooler than usual, had ample rainfall. Thus the drought effects of late May were broken before becoming serious. The good growing conditions in early May, the drought during the latter half, and the cooler than usual June weather either prevented or delayed early spore distribution of many disease pathogens and generally resulted in a low incidence of many diseases.

The summer months were somewhat spotty in rainfall but no prolonged drought spells occurred until late August and September, which were generally dry. The first half of October was wet, rains were frequent and prolonged. These conditions influenced the tree

diseases. A knowledge of 1959 weather will give the reader a better understanding of the disease effects discussed under the following headings.

Rusts

White pine blister rust (Cronartium ribicola).--Seasonal growth of white pines was reported as average from Maine and New Hampshire. New York reported exceptionally heavy seedling. White pine is generally increasing in acreage and stocking, mainly due to natural regeneration in old fields. Planting programs have also been expanded as a result of the Soil Bank Program. In Pennsylvania white pine ranked with the best of other species on soil-bank plantings. Plantings of blister rust-resistant white pines in West Virginia continue to grow without blister rust infections, although check trees are nearly 100 percent infected.

The past year was not too favorable for blister rust infections, although in West Virginia it was reported as about normal. New infections of white pine in New England are generally low, even though small, recently killed white pines in scattered locations were reported from New Hampshire, southern Maine, and north-central Massachusetts.

Aeciospore production appeared about average for the region as a whole, but aecial production was reported as heavy in Vermont and New York. Ribes infection was generally light, with few exceptions, where reports of it were medium to heavy. A West Virginia report stated that Ribes was moderately infected, with about 5 to 10 percent of the leaves infected. Permanent Ribes-infection plots were established in nearly all counties where control programs are active. These will be compared from year to year.

Telia production was generally light in West Virginia, and the "Highlight Report" from Regions 7 and 8 states that weather conditions as well as general observations of telia development indicate a light infection year. Lack of rain during August and September caused early Ribes defoliation in West Virginia, and the hot dry weather in late summer caused similar defoliation elsewhere.

Eradication programs were mostly completed as scheduled. Chemicals were used extensively for Ribes suppression, almost entirely in Maine and New Hampshire and with increasing acceptance elsewhere. A total of 12,000 acres of Ribes concentration areas were chemically treated. Posttreatment checks showed very good results. The invert emulsion of 2,4,5-T seemed quite effective, and it will be evaluated further in 1960. The checking of worked areas received increased attention during 1959 and 75 percent of the 1-percent goal was obtained. Of the areas checked, 48 percent rated very good (less than 5 F.L.S. per acre); 32 percent rated average (6 to 12 F.L.S. per acre); and the remaining 20 percent rated poor (13 to 20 F.L.S. per acre). Areas with more than 20 F. L.S. per acre were reworked before the final check.

Other activities connected with the blister rust eradication program involved nursery sanitation inspections and tests with Acti-dione. Satisfactory conditions were found in most nurseries and there was no need for intensive eradication, except for a new nursery in Maine which required intensive coverage of about 230 acres to insure protection. Approximately 1,000 acres were treated with Acti-dione in study plots well distributed throughout the region. Three general methods of application were used: basal spray, slit cankers, and canker treatment without slitting. Experimental formulations varied from 50 to 300 p.p.m. Results, while not conclusive, indicate favorable reactions on about 75 percent of the treated trees with little or no toxic effects to the white pines.

Early in the season two reports of unusual amounts of rodent feeding were received, both from New York. One told of the worst mice feeding on blister rust cankers of young trees that had been observed for the past several years. The other report concerned extensive girdling of gooseberries in the St. Lawrence Seaway area.

The following table was extracted from the "1959 HIGHLIGHT REPORT OF BLISTER RUST ACTIVITIES" in Regions 7 and 8.

WHITE PINE BLISTER RUST CONTROL ACCOMPLISHMENTS FOR 1959

State	Acres examined for Ribes	Premaintenance intensively worked	Maintenance acres intensively worked	Total acres intensively worked	Ribes destroyed (worked & examined) Area	Acres chemically treated
Maine and New Hampshire	493,279	2,724	2,580	5,304	904,556	4,237
Vermont	90,843	8,203	8,945	17,148	148,854	5,605
Massachusetts	39,057	1,678	111	1,789	25,503	10
Connecticut	48,589	--	235	235	46,871	13
New York	436,560	38,513	29,159	67,672	730,789	633
Pennsylvania	103,585	425	1,139	1,564	48,273	339
Maryland	862	1,967	--	1,967	186,568	380
West Virginia	93,264	15,123	6,264	21,387	95,573	32
TOTALS	1,306,039	68,633	48,433	117,066	2,186,996	11,249

Other rusts.--That rust diseases in 1959 were comparatively light and unimportant throughout most of the Northeast was reflected in the reports of various other rusts. Needle rusts seldom cause much damage. Red pine needle rust (Coleosporium asterum) is usually the most noticeable of these. The disease was reported as heavy on small planted trees in Westbrook and Windham, Me., rendering whole trees orange in color. Maryland also reported the disease present. It was also general in St. Lawrence County, New York. The only other report of the disease was its presence on red pine in Pelham, Mass.

Other reports of needle rusts included one from Delaware of needle rust of loblolly pine as being unusually heavy; one from Maine of fir needle rust on Bigelow Mountain, and light infestations in Aroostook County on Mount Katahdin and Spencer Mountain; also one that spruce needle rust was severe on red spruce at Bar Harbor and light localized infestations were present at New Harbor and Boothbay Harbor. A single blue spruce in Enfield, Me., was moderately infected. Cronartium fusiforme in southern Maryland was reported generally light in plantations and slight in natural stands of loblolly pine. Ash leaf rust (Puccinia sparganioides), a disease limited to coastal areas, was light to very light in Maine, New Hampshire, and Massachusetts.

Two species of the Gymnosporangium rusts were reported--Gymnosporangium clavariiforme and G. juniperi-virginianae. Both produced moderately heavy telia on dwarf and red cedars, respectively. The apple rust phase of the latter was quite prevalent according to reports received from New Hampshire, Massachusetts, and West Virginia. The cedar apple phase of the disease was common on red cedar in all types of environment according to a report from southern Maryland. Concerning other rusts, sweetfern blister rust (Cronartium comptoniae) was reported on jack pine near Peru, N. Y., and poplar leaf rust was noted in Lewis County, New York.

In summary then, it appears that the rusts got off to a good start in 1959, particularly the canker-forming rusts; but general weather conditions were such that the diseases were checked in their later developments and 1959 was, on the whole, a mild year from the standpoint of rust disease damage.

Foliage Diseases

The variety and severity of foliage diseases were less than usual in 1959. They were generally scattered, variable in severity, and late in appearing. When severe, localized infections of the foliage diseases were limited geographically and did not extend over wide areas. Yet for a light damage year from foliage diseases, the number encountered or reported was rather surprising, as the following reports indicate.

The anthracnoses.--Reports were quite uniform in indicating a surprisingly slight amount of damage from both oak and sycamore anthracnoses. Both diseases were light and difficult to find during the early part of the season. This was quite different from 1958, when sycamore anthracnose and, to a lesser degree, oak anthracnose were very severe. Last year the extent and damage of the sycamore diseases was one of the worst on record. Generally the anthracnoses became more evident late in the 1959 season, during the hot humid periods of July and August but damage was slight or negligible. A Delaware report stated sycamore anthracnose as evident in the spring and causing considerable defoliation, but this was exceptional for most of the Northeast. Oak anthracnose in Delaware was serious only on occasional specimens. West Virginia reported sycamore and oak anthracnoses as very light.

Other anthracnoses were generally unimportant though a number were reported. For example, in Massachusetts Gloeosporium sp. were recorded from Norway maple, Tilia sp., sugar maple, birch, red maple, and Babylonian willow. Pennsylvania reported G. apocryptum on Norway maple, and Maine reported ash anthracnose as light on white ash in the Cape Elizabeth area. In West Virginia anthracnose on black walnut was noticeable, but it was much worse in 1957 and 1958.

Leaf spots.--Leaf spot diseases were rather inconspicuous during 1959, although a number were reported, a few as fairly widespread and prominent. Damage from leaf spots is usually slight even though they are unsightly and may cause varying degrees of defoliation. Reports from Pennsylvania stated that Phyllosticta leaf spot was common and widespread on red maple, especially

on understory trees; black spot of elm (Gnomonia ulmea) was widespread throughout the state and became more prominent and its symptoms intensified as fall approached; cherry leaf spot was noted but did little damage; Venturia scab occurred on apple and related plants but damage was slight; Gnomonia leptostyla was widespread and resulted in premature defoliation of black walnut. Massachusetts reported a Phyllosticta sp. on Rhododendron in Canton and Amherst; also that Entomosporium thuemenii leaf spot was fairly general in the eastern part of the state; and black spot of elm (Gnomonia ulmea) was severe along Route 10 in the northern part of the state. A report from Maryland tells of light to moderate infections of silver and red maple by a leaf spot disease. New Hampshire reported tar spot of maple as present, but of minor importance. West Virginia stated that leaf spots and blotches did not appear to be very noticeable, and few inquiries about them were received.

Leaf blotches and blights.--The variety and severity of these diseases were generally less than usual. Reports indicated they were scattered and of variable severity. In general, they appeared later in the season than usual. Horsechestnut leaf blotch (Guignardia aesculi) is an example. It occurred rather widely in New Hampshire, other New England states, and in New York and Pennsylvania. The disease was light to moderate in intensity and though late in appearing, it became increasingly evident as the season progressed. Severe local spots of the disease were often observed, particularly in western New York and south-central Pennsylvania. A somewhat similar situation held for Fusicladium willow blight in New York and the New England States. Generally, however, the disease resulted in only minor damage. These seemed to be the principal leaf and blotch diseases. A few others, reported during the year, apparently were less extensive and are mentioned in the following section.

Miscellaneous blights and diseases.--Pennsylvania reports that tip blight (Diplodia pinea) on Austrian and Scotch pines in western parts of the state appears to have increased in intensity. The same source reported a leaf scorch of maple and birch that seemed to be correlated with August weather conditions. White pine needle blight was not conspicuous in the New England States, and few reports of it were received, although Maine

reported it present in several localities within the State. Some of the larger trees were affected. In the eastern border counties of West Virginia it was present and severe on affected trees, but not widespread.

Taphrina leaf blister affected several hundred acres of black oak in the vicinity of Mount Washington in Massachusetts. A report of false mildew of mulberry came from Maryland. The disease apparently appeared late in the season, and it was thought that high fall temperatures probably favored its development. This is the first report to mention this disease. Another disease seldom reported is Exobasidium vaccinii, which caused white galls on leaves of Rhododendron maximum in natural stands near Lexington, Maine. The X-disease of cherry, a virus, was observed over wide areas late in August; symptoms of the disease became more conspicuous as the season advanced. Maryland Forest Service personnel reported that sweetgum blight, although present in the central part of the state, was not as severe as it was five years ago. Dieback of sweetgum was also reported from Delaware, New Jersey, and West Virginia. Maine reported that Botrytis tip blight was observed in a balsam fir Christmas tree plantation in Waldoboro and on dwarf juniper nursery stock. Frost injury was apparently associated with the disease.

Chestnut sprouts blighted by Endothia parasitica are common throughout the Northeast. Maine reported a large number of American chestnut sprouts in East Winthrop, some 3 inches in diameter with many of them blighted. A good crop of nuts was produced on many of the sprouts. Root crown and roots of chestnut are generally more resistant to the disease, but a Japanese-American hybrid in Washington, Me., measuring 10 inches d.b.h., contained numerous cankers in limb crotches, on its trunk and root crown, and on one exposed root. Chestnut blight was observed attacking all chestnut sprouts 6 feet and larger in southern Maryland. The same source reported a leaf blotch common on most laurels and on holly trees.

Nursery and Plantation Diseases

Winter injury to nursery stock included frost heaving, mainly affecting seedlings in unmulched beds,

and top kill of Japanese larch seedlings in New Hampshire. These larch seedlings had made very good growth in late 1958 which left the seedlings in a tender and unhardened condition. Other reports of nursery troubles concerned damping-off complexes, fertilizer deficiencies, and a disease caused by Cylindrocladium scoparium.

Various root rots in forest nurseries are becoming prevalent and such troubles were reported from Vermont, New Hampshire, Pennsylvania, and West Virginia. Delaware reported a root dieback of 3- or 4-year-old hemlocks and yews, which appeared in August following heavy rains. Three nurseries suffered losses. Isolations, using the "apple" technique, yielded cultures of Phytophthora cinnamomi.

Nursery and plantation diseases often result from the same cause. Two needle cast diseases affecting Douglas-fir Christmas tree nursery stock, caused by Rhabdocline and Adelopus, were widespread in Vermont, New Hampshire, Connecticut, and New York. Massachusetts reported on finding the conidial stage of a leaf cast disease (Hypoderma sp.) affecting red pine at South Hadley. Plantation diseases of unknown or uncertain causes included a dieback of leader and laterals of Scotch pine in Cortland and Chenango Counties, New York; a deformation, loss of terminal buds, and proliferation of buds resulting in forking of white pine was reported from New Hampshire and Maine; while Pennsylvania reported a needle tip blight of unknown cause affecting Austrian and Scotch pine in Christmas tree plantings in Indiana County. Other plantation diseases are reported elsewhere (see sections on Root Rots, Rots, Cankers, and Miscellaneous Diseases for further details).

Cankers

Common perennial tree cankers were evident, of course, such as Strumella canker of oak, Nectria canker on birches and maples, and Hypoxylon canker on poplars and aspens. Reports for 1959 mostly concerned types of cankers other than the large, conspicuous, common, perennial cankers mentioned above. Among them were reports of unusual cankering organisms, many of little importance but which are not often reported. Bleeding canker of maple (Phytophthora cactorum) was mentioned more often than usual, but it is uncertain whether or

not this indicated unusual activity by the canker-producing organism. Reports of it were received from Maine, New Hampshire, and Vermont. In Maine, affected trees were generally associated with poor growing conditions, root-damaged trees, or trees affected by fill or soil compaction.

As might be expected, Cytospora kunzei was reported several times since it is common and widely distributed, especially in spruce plantations. Maine reported heavy spore production by the fungus during a rainy period in early August from infections on ornamental spruces. A Vermont report stated the disease was widespread in Norway spruce plantations, with a higher incidence and virulence on poorer sites and mostly in unthinned stands. An attempt to remove all infections from a portion of one stand several years ago resulted in new infections in residual trees in and on the periphery of the cut area. Another 2-1/2 acres has been set aside and marked for heavy and light control thinnings to find out how such stands might best be managed for disease control.

The beech scale-Nectria disease is increasing in New York State according to a recent report. The infestation area extends north of Long Island to Warren and Chenango Counties. It has been found in Rensselaer and Columbia Counties as well as the Catskill Mountain area. New Hampshire considers this disease as one of its most serious of the hardwood forest in the northern part of the State. Beech plot data for 1958, reported from Maine, indicated thinning appeared to favor scale abundance, but seemed detrimental to development of the Nectria fungus. Heavy mortality still occurs in parts of the State, but it was also reported that the Nectria was as yet only associated with light scale infestation in the Rockwood area. The beech scale-Nectria infestation, previously reported from Pennsylvania, is being carefully watched for further developments.

A number of reports concerned lesser known canker-producing organisms and hosts. Pennsylvania reported a species of Pyrenochaeta associated with stem and branch cankers of young sugar maples, causing considerable dieback and mortality in a sugar bush in Somerset County; also, that redbud canker, caused by Botryosphaeria ribis, seemed more prevalent than usual.

Massachusetts informants cited a number of canker-producing organisms from various hosts. Reports told of finding the conidial stage of Nectria cinnabarina on a stem canker of 1-inch nursery trees of Sophora japonica shipped into the State; of Diatribe stigme occurring on dead or cankered twigs of Salix discolor; of black knot (Dibotryon morbosum) on Prunus sp.; of a Sphaeropsis sp. cultured from cankered twigs of Robinia pseudoacacia; of a Phoma sp. from the stem of a dead white pine seedling; of Cytospora sp. from branch cankers of gray birch, ash, white pine (trunk), sugar maple (trunk), and from a Japanese maple dying from other causes; of Steganosporum sp. from twigs of sugar maple; of Pestalotia sp. from needles, twigs, or leaves of a number of plant species; and finally, of a mulberry tree severely cankered by a Dothiorella sp.

The canker-stain disease caused by Ceratocystis fimbriata f. platani was reported from Harrisburg, Pa., and from Pendleton Count, West Virginia, the latter on native sycamore. Black knot (Dibotryon morbosum) occurred on practically all wild black cherries in southern Maryland, according to a report from that section. An unidentified fungus-caused canker was reported to cause slight, but scattered, damage to native red spruce in the Monongahela National Forest in West Virginia.

Root Rots

Fomes annosus has become the number one problem root rot in the Northeast within the last two or three years. The fungus is widely distributed and collaborators for the NORTHEASTERN FOREST PEST REPORTER are sending in more and more reports on new locations and additional hosts damaged or killed by the disease. As more people become better acquainted with the disease and more attention is given to this critical forest problem, such reports will increase. Investigations of the disease are increasing by state, federal, and private individuals. We may expect more effort will be devoted to prevention and to minimizing the damage from the disease, and toward finding practical control measures. Additional personnel and money are badly needed for attacking the many unsolved problems presented by this disease.

The following highly condensed summary has been compiled from reports received. Connecticut: Several new locations, mostly in red pine plantations, in addition to those previously known. Delaware: An increase in death of red cedar resulted from the disease. Maine: reported no additional mortality in Leavitt plantations since diseased and buffer zones of healthy trees were bulldozed and burned two years ago. Maryland: Reported outbreaks of F. annosus in western part of the State. Massachusetts: Additional hosts and locations found. New Hampshire: Known distribution extended and new hosts discovered. State-sponsored investigations increased. New York: Now in 19 counties, a number of new locations and hosts found. Survey work increased and more State personnel used in investigating the disease. Pennsylvania: Found in at least seven counties; eight different hosts reported. Vermont: Additional F. annosus locations reported. West Virginia: Disease found in Clover Run red pine plantation on the Monongahela National Forest, with evident damage present for the past two years. This is the first report of the disease in West Virginia plantations, although it has been observed on native red cedars. A statewide survey for the disease in plantations is planned, even though most plantations are still too young for the disease to be a problem.

The following 11 hosts were reported during 1959: Austrian pine (Pinus nigra) - New York; banks or jack pine (Pinus banksiana) - Pennsylvania; black cherry (Prunus serotina) - Massachusetts; eastern red cedar (Juniperus virginiana) - Delaware, Massachusetts, and Pennsylvania; eastern white pine (Pinus strobus) - Connecticut, Massachusetts, New Hampshire, New York, and Pennsylvania; larch (Larix sp.) - New York, Pennsylvania; Norway spruce (Picea abies) - Massachusetts; pitch pine (Pinus rigida) - Pennsylvania; red pine (Pinus resinosa) - all states except Delaware; Scotch pine (Pinus sylvestris) - Massachusetts, New Hampshire, New York, and Pennsylvania; Virginia pine (Pinus virginiana) - Pennsylvania.

Other root rots.--Polyporus schweinitzii root rot was commonly observed and identified by the presence of old fruit bodies of the fungus. Very few fresh conks were observed. Several reports were received of red and white pine plantation trees killed by this rot.

Considerable damage to old white pines was observed. In a 25-year-old larch plantation numerous blowdowns resulted from badly rotted root systems, and the plantation had to be clear-cut for salvage purposes. The amount of butt rot in the latter two species was extensive. Armillaria mellea appeared to be quite common. A report from Massachusetts told of its occurrence on understory dogwoods, and it appeared to be associated with, if not the principal cause of, a decline of red pines in a Vermont State Forest. New Hampshire reported the fungus from declining maples, and West Virginia said it was cultured rather frequently from yellow poplar sprout stands in experimental plots near Morgantown. Coniophora puteana, a common brown cubical root and butt rot of many conifers and hardwoods, was observed fruiting 15 to 20 feet above ground on the outer bark of dead, standing white pine trees. Usually this fungus fruits on down wood on the forest floor.

Heart Rots

Heart rots are ever-present and cull losses and other damage, such as breakage, remains fairly constant. During 1959, Steccherinum septentrionale, a common heart rot fungus of sugar maple, seemingly fruited in unusual abundance, especially in parts of Massachusetts and New Hampshire. The fungus was also observed fruiting on other hardwood hosts on which it is seldom found. Polyporus squamosus, a fungus commonly fruiting on elm during the early season, was observed fruiting frequently in late July and August. Fall fruiting of the fungus is not as common as early-season fruiting. A very common saprophyte of many hardwood hosts, Fomes applanatus, was observed fruiting on living maples, beech, and birch trees to a greater degree than usual. A Vermont report states that Stereum sanguinolentum accounted for 5 to 8 percent cull in two Norway spruce plantations which were thinned this past year. Pruning wounds appeared to be the most common means of entrance for the fungus, although porcupine damage sites and other means of entry are also probably involved. In West Virginia, heart rot is a perplexing problem in oak stands of the Eastern Panhandle, and the situation is one that needs evaluation. Fomes pini occurs commonly on trees damaged by logging and on limby loblolly pines bordering woodlands in southern Maryland.

Witches' Broom

With few exceptions, witches' brooms are of more interest as curiosities and for the diversity of their causal organisms than they are important. No unusual abundance was noted in 1959, and at least one, the Taphrina witches' broom of wild cherry, seemed less common than usual. Vaccinium witches' broom (Calyptospora goeppertiana) was noted in north-central Massachusetts and southern New Hampshire, where scattered centers of abundance occurred. In the same general region, widely scattered, spectacular centers of infection of Apiosporium collinsii were observed on Amelanchier sp. Dwarf mistletoe on white and red spruce continues to be a problem in the coastal areas of Maine and on some of the offshore islands. Other reports noted the presence of a willow witches' broom of unknown cause in southern New Hampshire, and a large witches' broom of larch in Maine. No reports of other common witches' brooms, especially those caused by rusts, were received. Rust-caused brooms of several of the conifers, however, are common throughout most of the Northeast.

Wilts

Dutch elm disease.--With the exception of Maine, where disease symptoms were delayed due to a cold spring, symptoms of Dutch elm disease appeared early in the season. Reports for all three issues of the NORTHEASTERN FOREST PEST REPORTER attested to the severity of the disease and its increasing importance, from West Virginia, Maryland, and Delaware, up through the New England States. Special season-end reports received from the following states indicate the trend of the disease in the Northeast. Maine reports cultural confirmation of the following elm samples for 1959; Dutch elm disease - 259; Cephalosporium - 37; and Verticillium - 17. The disease has now been found in 100 towns in Maine. It is still increasing in New Hampshire. Delaware has experienced an increase in the severity of the disease during the past 5 years, and it is now found throughout the State. Other states reported it as unusually heavy for 1959.

Oak wilt.--Apparently no startling or unexpected changes in the oak wilt situation occurred during 1959.

Mimeographed reports on the culture and laboratory operations, and on the control activities against oak wilt in Pennsylvania by W. L. Yount and Arthur R. Jeffery, respectively, have been used to obtain the following information. These reports are issued annually by the Bureau of Plant Industry, Pennsylvania Department of Agriculture, Harrisburg, Pa.

For 1959, 71 single infections, 232 group infections, and 102 breakover areas were found and treated. The total of infected areas treated was 405. Since the discovery of oak wilt in Pennsylvania in 1950, some 3,000 survey cultures have been made. Of these, about 1,800 have cultured positive. During 1959, 358 samples were cultured, 200 of which were positive. Positive identifications were distributed as follows: red oak, 173; white oak, 1; black oak, 19; scarlet oak, 2; pin oak, 2; chestnut oak, 1; unknown oaks, 2. For further details consult the two reports mentioned above.

Data on the status of oak wilt in West Virginia has been taken almost verbatim from the "Report of the 1959 West Virginia Oak Wilt Program," by W. H. Gillespie and F. W. Craig, published as Special Survey Report No. 9, West Virginia Dept. of Agriculture, Charleston, W. Va. The report also contains a brief account of the accomplishments and the present activities of the research program in the State, prepared by R. P. True, Forest Pathologist, West Virginia University. Consult this report for further data.

During the season 2,414 trees were treated by the deep-girdle technique in 1,812 infection centers in 44 counties. Of the trees treated, 296 were breakovers of 175 centers that had been treated in prior years. The disease was found in Barbour and Monroe Counties for the first time bringing the known totals in West Virginia to 7,104 trees in 4,929 centers in 48 counties.

Of the 1,637 centers initially located in 1959, 56.6 percent were new infections, presumably the result of long-distance spread, and 41.3 percent of the 1,637 infections had no dead oak trees within 150 feet of the plot center. The average-sized tree found in 1959 was only 13-1/2 inches d.b.h.; however, in those counties outside the Eastern Panhandle the average was nearly 19 inches. An average of 1.3 wilting trees, 5.3 compatible

nondiseased trees, and 0.9 dead trees were found within the centers located in 1959.

The overall trend of oak wilt in West Virginia is reassuring in spite of the large increase in the number of wilting oaks processed in 1959. Most of this increase was in the Eastern Panhandle, and it was perhaps more apparent than real, since a large portion consisted of old centers that had been missed in previous years. Here the infected trees were in small-sized, nearly even-aged stands, which in combination with other reasons made scouting and finding the infected trees difficult. The situation in the remainder of the State was about the same as in 1958, even though survey activities were intensified. For the first time, less than half of the newly found trees were at old infection centers, thus indicating that the survey is gradually finding most of the old centers which existed before statewide surveys were started. Studies have revealed that competing fungi, especially Hypoxylon punctulatum, are effective in shortening the life of the oak wilt fungus in dying trees. Further studies are in progress of the effect of inoculating naturally-diseased trees with Hypoxylon at the deep-girdle wound. This may be a promising addition to available control measures.

In Maryland during 1959, three aerial surveys were conducted over Garrett, Allegany, Washington, and Frederick Counties, in cooperation with Pennsylvania personnel. About 40 areas suspected of disease were located. These appeared to be in the same sections where the disease had been located previously, and there was no evidence of spread into additional sections. Oak wilt has been found from Fairview Mountain, Washington County, west into the eastern edge of Garrett County, with the disease centered in Allegany County.

The U. S. Forest Service has established a number of study plots in the oak wilt areas of Pennsylvania, West Virginia, and Maryland. These plots will evaluate the effectiveness of the various control measures used and help determine the most economical methods of control treatments.

Other wilts.--Nothing unusual or unexpected was reported for other wilts during 1959. Maryland reported mimosa wilt as being suspected of spot mortality of

mimosa trees on the lower Eastern Shore. Verticillium wilt was reported from Maine, Massachusetts, New Hampshire, and Pennsylvania. In connection with the Dutch elm disease survey in Maine, Verticillium was found in 17 elm trees, while the Cephalosporium wilt organism was isolated from 37 elms.

Miscellaneous Troubles and Diseases of Unknown Cause

In addition to a needle cast of pitch pine in Pennsylvania suspected as caused by a Hypoderma sp., and those mentioned elsewhere in this report, were several needle casts of unknown causes but generally believed to be of nonpathogenic origin. These included a needle cast of white pine reported from Massachusetts, a needle cast of red spruce from the Green Mountain area of Vermont which was apparently not correlated with site or exposure and seemed similar to the needle casts of red and black spruce reported to occur in New Brunswick and Newfoundland.

Weather conditions.--Widespread winter injury killed or severely injured many exposed coniferous and broadleaved evergreen ornamentals throughout the Northeast. Details have appeared in regular issues of the NORTHEASTERN FOREST PEST REPORTER. A report from Maine told of hail damage to pines at Greenbush and to white pine and hardwood species at South Paris. Practically no late frost injury was reported this season. In Pennsylvania, leaf scorch from dry weather appeared on a number of different species in late August and September. Previous drought has been correlated with oak decline at some places where the trouble occurs.

Tree decline and dieback.--Of the number of perennial troubles of this nature, oak decline, dieback, or mortality, as it is variously reported, is one of the most serious. It is found throughout the territory, but to a lesser degree in New England than elsewhere. Throughout Delaware it affects principally red oak. Oak decline in eastern Maryland has been a problem since 1950. Heavy oak mortality occurred on Sugar Loaf Mountain following insect defoliation in 1957, and large red and pin oaks have died in suburban Washington and Baltimore areas. In West Virginia, oak decline has affected localized acreages, especially in Hardy and Hampshire

Counties, as well as other scattered localities, where scarlet and black oaks are the primary victims. White oaks in Morgan County and in southern Hardy County have died while black and scarlet oaks showed incipient symptoms. Occasional chestnut oaks are affected, many showing a dieback condition.

There are many puzzling aspects to the non-oak wilt troubles in West Virginia, and the basic causes may differ with the various species and localities. Several published reports have appeared on the West Virginia oak decline problem. Oak decline has caused considerable mortality in oaks in north-central Pennsylvania and parts of New York State. This is under investigation.

Leaf scorch is, in many cases, a part of the syndrome of maple dieback, but not necessarily, as shown by the Pennsylvania report of leaf scorch affecting several hardwood species in late August and September of 1959. Leaf scorches often result from high, drying winds during drought periods.

Maple deterioration is a cause of some concern in New York, Pennsylvania, and all the New England States, yet it received scant mention in reports submitted for the 1959 issues of the Pest Reporter. New York reported that it is mainly a problem of roadside trees, lawn ornamentals, and hedgerow trees, and that they have no reports of its occurrence in the forest. This seems most generally to be the case. Reasonably good growing conditions for the past two years, and the death of large numbers of the most severely affected maple-dieback trees during the past three or four years, seemingly have left the living residual trees looking comparatively better. The trouble, however, is readily evident throughout most of the region.

Ash dieback reports were limited this year; the most alarming, received from New York, stated, "This problem on white ash seems to be slowly intensifying each year. Field reports indicate it now ranges from Long Island northward into Rensselaer County, then in a westward direction to Chautauqua County. At first it appeared to be a problem of roadside and hedgerow trees but in recent years it has invaded the forest." Another report stated that it was particularly severe in the Poughkeepsie area.

Animal injuries.--Reports of mice girdling under last winter's snow were received from New York and Maine. Evidently such damage in localized areas was greater than usual. Bird damage due to heavy grosbeak feeding on Scotch pine buds occurred at Harrison, Me. Similar damage has been observed in Massachusetts, and has also been reported from New Hampshire and New York. More reports have been received of bird injury to Scotch pine than on other species. Sapsucker injury to Austrian pine and birch was reported from Maine and Massachusetts, respectively. Porcupine damage is widespread throughout the Northeast. Reports of such damage are noted from Maine, Massachusetts, and Vermont. Deer damage, although extensive, is seldom reported. One report from Vermont tells of damage to hemlock, where bark was stripped from trees up to 10 inches in diameter to heights of 6 to 8 feet. Far greater deer damage occurs on young reproduction.

Miscellaneous troubles.--Among the various nonpathogenic troubles were salt injury and herbicide damage. Concerning the former, there were reports of salt injury to roadside trees in the New England States with white pine and hemlock being the species involved. A report from southern Maryland tells of salt damage occurring along edges of salt marshes during high waters. Loblolly pine was the tree species most markedly affected. Herbicide damage was reported from Massachusetts and Maine. As the use of herbicides is increasing, this type of chemical injury will undoubtedly become more common.

Birch dieback is still a problem, but probably not as alarming as it was a few years ago. Reports on the disease were received from New Hampshire and Maine, the latter stating it has remained fairly stable. A beech decline, where chlorotic, thin foliage and twig mortality are early symptoms, followed by branch and crown dieback, has been noted for the past few years in southern New York. Its cause is unknown, but some complex is believed involved. A chronic, fall chlorosis of Norway pines in a plantation in Woolwich, Me., has apparently been corrected by application of 2 oz. of muriate of potash (60% K_2O) per tree, just prior to the growing season. Word from New York tells of three unknown troubles: one causing considerable mortality of young white pine in areas of Clinton and Essex Counties; another causing mortality of young and pole-sized white pines

characterized by bleeding butt cankers; and, finally, of a deterioration of black walnut found in the section of the State between Hemlock and Honeoye Lakes. Dying of balsam fir was reported as common in Vermont and New Hampshire. The trouble is presumably a complex of insect feeding, principally by Monochamus, followed by infections by several weak parasitic fungi.

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Table 1.--The forest insect situation in the Northeast, 1959

MAJOR FOREST INSECTS

Insect	Host	Locality affected	Extent	Degree of infestation	Recommended control action
Spruce budworm	Balsam fir; white, red, & black spruces	Maine (northern)	General	Light-heavy	Airplane spraying with DDT of approximately 175,000 acres.
Pine sawflies	All pines	Regionwide	General	Light-heavy	Spray with DDT where feasible; use virus sprays where applicable.
Balsam woolly aphid	Balsam fir	Maine, New Hampshire, Vermont, New York (Adirondacks)	General	Light-heavy, severe stem attack currently in Me., N.H., & Vt.; increased gout injury in coastal areas of Me.	Sanitation-salvage cuttings where feasible; shortened rotation.
European pine shoot moth	Red, Scotch, & mugho pines	Regionwide, except northern New England and New York	General	Light-heavy, heaviest in Md., W. Va., & Pa.	Where feasible, two applications of DDT 2-3 weeks apart with ground equipment beginning at moth emergence.

(continued)

Table 1.--(continued)

Insect	Host	Locality affected	Extent	Degree of infestation	Recommended control action
Nantucket pine tip moth	Loblolly, Virginia, & other pines	Massachusetts (Cape Cod), Connecticut, southwestern New York, New Jersey, Delaware, Maryland, W. Virginia, southern Pennsylvania.	General	Light-heavy, most serious in eastern Md.	2-3 applications of DDT per generation, with ground equipment, beginning at moth emergence.
Pine leaf aphid	White pine & red spruce (alternate)	Northern New England, New York	General over region, spots localized	Light-heavy, increasing importance in Me.& Vt.	Spray with contact insecticide where feasible.
Red pine scale	Red pine, several ornamental pines	Southwestern Connecticut, southern New York & Long Island	About 250+ sq. mi. encompassed around Bridgeport, Conn. area, plus spots in southeastern N.Y. & L.I.	Tree mortality in Bridgeport area, mortality imminent in infested areas.	Destroy infested trees.
White-pine weevil	White pine, Norway spruce, & other conifers	Regionwide	General	Light-heavy	DDT or lindane with extender in early spring by helicopter; knapsack sprayer in small areas.

Pales weevil	Young conifers	Regionwide	Localized	Light-heavy	Do not replant for 2 yrs. after cutting. Spray seedlings with lead arsenate or 2% aldrin emulsion. Dip tops in 1% BHC suspension before planting.
Forest tent caterpillar	Maples, oaks, & other hardwoods.	Pennsylvania, W. Virginia, & Maryland	General	Heavy	Spray with DDT where feasible.
Eastern tent caterpillar	Cherry, apple, & other hardwoods	W. Virginia, Maryland, southern Pennsylvania, New York, Rhode Island, & Delaware	General	Locally heavy	Spray with DDT where feasible.
Gypsy moth	Hardwoods, hemlock & pines.	New England except northern Maine, Vermont & New Hampshire; eastern & central New York, northeastern Pennsylvania, northern New Jersey.	General	Light-heavy	Airplane spraying with DDT, mist blower where feasible.
Orange-striped oak worm	Oaks, other hardwoods	Rhode Island, Connecticut, New York, south central Pennsylvania, northern Maryland, & New Jersey.	General	Light-heavy	Spray with DDT where feasible.

(continued)

Table 1.--(continued)

Insect	Host	Locality affected	Extent	Degree of infestation	Recommended control action
Variable oak leaf caterpillar	Oaks	Regionwide	Localized	Light-heavy	None.
Beech scale	Beech	Northern New England	General	Light-heavy	Sanitation-salvage cutting where feasible; drench-spray with contact insecticide.
		New York & Pennsylvania	Localized	Light	
White pine cone beetle	White pine	Regionwide	General	Light-heavy	None.
Root collar weevil	Jack, Scotch, & red pines	Regionwide	Localized	Light-heavy	Spray ornamentals and Christmas trees with BHC at ground level.
Ips engraver beetle	Pine & other conifers	Regionwide	General	Light-heavy	Avoid injury to residual trees in logging operations. Remove slash. Remove infested and high-risk trees where feasible.
Pine (and Saratoga) spittlebugs	Pines	Regionwide	Localized	Light	Spray with DDT where feasible.

Pine needle miner	Pitch & shortleaf pines	Southern New Jersey, Massachusetts & Delaware	Localized	Moderate-heavy	None.
Pine needle scale	Pines	Regionwide	Localized	Light-heavy	Spray ornamentals and Christmas trees with contact insecticides.
Pine bark aphid	White pine	Regionwide	Localized	Light	None.
Balsam gall midge	Balsam fir	Maine, Vermont	General	Light	None.
Spruce gall aphid	Norway, red & white spruces	Regionwide	General	Light-heavy	Spray ornamentals with malathion.
Cooley spruce gall aphid	Spruces	Regionwide	Localized	Light-heavy	Spray ornamentals with contact insecticides before galls open in spring.
Larch sawfly	Eastern & Japanese larch	Maine, Pennsylvania	Localized	Light	None.
Pine gall weevil	Red & Virginia pines	Pennsylvania	Localized	Light	None.

(continued)

Table 1.--(continued)

Insect	Host	Locality affected	Extent	Degree of infestation	Recommended control action
Pine tip moths	Scotch, white, Austrian, & red pines	Regionwide	Localized	Light-heavy	None.
Turpentine beetles	Pines	Regionwide	General	Light-heavy	Avoid injury to residual trees when cutting, remove infested trees where feasible.
Yellow-headed spruce sawfly	Spruces	Maine	Localized	Light	None.
Bagworm	Red cedar, black locust, other conifers & hardwoods	New Jersey, Delaware, Maryland, W. Virginia, southern Pennsylvania	General	Light	Spray with lead arsenate or toxaphene where feasible.
Red-humped oak worm	Oaks & other hardwoods	Regionwide	Localized	Light-heavy, most serious in eastern Conn.	None.
Saddled prominent	Hardwoods	Regionwide	General	Light	None.

Gregarious and solitary oak leaf miners	Oaks	Massachusetts, Rhode Island, Connecticut & New York (Orange County)	Localized	Heavy	None.
Yellow-necked caterpillar	Hardwoods	Delaware (New Castle County)	Localized	Heavy	None.
Oak leaf roller	Red, scarlet, & scrub oaks	Massachusetts, Pennsylvania	Localized	Heavy	None.
Maple leaf cutter	Sugar maple	New York	Localized	Light-heavy	None.
Birch leaf miner	Birch	New England New York & New Jersey	General Localized	Light Heavy	Spray each brood with contact insecticide when mining first appears.
Satin moth	Willow, poplar, & aspen	New York	Localized	Light-heavy	Spray with DDT where feasible.
Imported willow leaf beetle	Willow	Massachusetts, Rhode Island & Delaware	Localized	Light-heavy	Spray with DDT where feasible.
Large aspen tortrix	Aspen	New York (Essex County)	Localized	Heavy	None.

(continued)

Table 1.--(continued)

Insect	Host	Locality affected	Extent	Degree of infestation	Recommended control action
Fruit tree leaf roller	Fruit & other deciduous trees	New York (Essex County)	Localized	Heavy	None.
Ugly-nest caterpillar	Cherry	Massachusetts	Localized	Heavy	None.
White-marked tussock moth	Hardwoods	Nantucket Island, Massachusetts, Delaware	Localized	Light	None.
Chain-spotted geometer	Shrubby hardwoods	Rhode Island (coastal)	Localized	Light-heavy	None.
Locust leaf miner	Locust	W. Virginia; New York (Greene County)	Localized	Light	Spray with contact insecticide where feasible.
Locust borer	Locust	W. Virginia	General	Light-heavy	None.
Asiatic oak weevil	Oaks	Delaware, Maryland, Pennsylvania (southeastern)	General	Light	None.
Fall webworm	Hardwoods	Regionwide	Localized	Light	Spray with DDT where feasible.

Mound-building ants	Conifers & hardwoods, especially in plantations	Regionwide	Localized	Light	Apply powdered chlordane at rate of 2 oz. per 2 feet of mound diameter.

Table 2.--The forest disease situation in the Northeast, 1959

Disease	Host	Locality affected	Extent	Degree of infection or damage	Recommended control action
Blister rust	White pine	Regionwide	General distribution	Aecial infections generally light to heavy; telial infections generally light; pine infections probably light-moderate	Ribes eradication: 1,306,039 acres examined; 2,186,996 ribes destroyed; chemical treatment used on 11,249 acres and increasing. Resistant pines known and being tested. Chemical treatment of blister rust cankers on pine encouraging.

(continued)

Table 2.--(continued)

Disease	Host	Locality affected	Extent	Degree of infection or damage	Recommended control action
Sweetfern rust	Hard pines	Localized; southern New Jersey & New York.	Limited	Light	Generally none needed; selective cutting of heavily cankered trees.
Pine needle rust	Red pine	Maryland, Maine, New York, & Mass.	Limited, localized & scattered	Generally light	None.
	Loblolly pine	Delaware	Limited	Heavy	None.
	Balsam fir	Maine (Aroostook County)	Limited, scattered	Light	None.
Spruce needle rust	Spruce	Maine (coastal)	Very limited	Light	None.
Fusiforme rust	Loblolly pine	Maryland (southern) & New Jersey	Limited	Slight	None.
Juniper rust	Dwarf and red cedars	New Hampshire, Massachusetts, W. Virginia & Maryland (southern)	General distribution; prevalent but	Heavy infections; damage slight.	Generally none; spray ornamentals with Ferbam. Resistant clones known but not generally used.

Leaf rust	White ash	Coastal areas of Maine, New Hampshire and Massachusetts.	Limited	Very light	Generally none; sanitation by destroying leaf litter; organic mercury sprays at bud break.
	Poplars	New York (Lewis County)	Limited	Light (?)	None.
Anthracnose diseases	Sycamore and Oak	Regionwide	General distribution	Extremely light moderate in	Sanitation measures; spray with organic mercuries starting at bud break (1-3 sprays).
	Miscellaneous hardwoods (see text)	Regionwide	Spotty general distribution	Light, seldom severe.	Generally none; control as above for valuable species such as black walnut.
Phyllosticta leaf spot	Maples	Regionwide	Spotty distribution	Little damage; unsightly.	None.
Elm leaf spot	Elm	Regionwide	Localized, Massachusetts & Pennsylvania	Moderate, late appearing	None usually; for ornamentals sanitation and Ferbam spray.
Entomosporium leaf spot	Hawthorn	Massachusetts (eastern)	Fairly general	Moderate to light	Usually none; sanitation; Bordeaux, Ferbam, or organic mercury sprays, if necessary.

(continued)

Table 2.--(continued)

Disease	Host	Locality affected	Extent	Degree of infection or damage	Recommended control action
Tar spots	Maple & willow	Regionwide	Localized and spotty	Minor importance	None.
False mildew	Mulberry	Maryland	Very localized	Light	None.
Galls and blisters (*Exobasidium*)	Rhododendron	Maine (Lexington)	Local	Leaf galls & blisters of minor importance.	Usually none.
Taphrina leaf spot	Black oak	Near Mount Washington, Massachusetts	Several hundred acres	Usually negligible.	None feasible.
Leaf and shoot blight	Horsechestnut	Regionwide	General where host occurs.	Light to moderate; increase toward fall.	Sanitation; organic mercury or Ziram sprays.
	Willow	New York & New England States	Usually localized and spotty	Light, only minor damage.	None usually practised; sanitation by pruning and litter destruction; Bordeaux sprays at bud break for valuable ornamentals; resistant species.

Tip blight (*Diplodia*)	Austrian and Scotch pines	Pennsylvania (western part)	Usually localized	Reported as increasing.	Usually none; copper or organic mercury sprays.
Sweetgum blight	Sweetgum	Delaware, New Jersey, Maryland, & West Virginia	General, usually somewhat spotty	Perennially severe; Maryland reports it as not as severe as 5 years ago.	None known; salvage severely infected trees.
Chestnut blight	American chestnut	Regionwide	General distribution	Severe	None effective; plant resistant hybrids.
Unknown tip blight	Austrian & Scotch pines	Pennsylvania (Indiana County)	In Christmas tree planting	Moderate (?)	--
X-disease virus	Wild cherries	Regionwide	General	Apparently light; late season appearance.	None feasible.
Leaf casts: *Rhabdocline* & *Adelopus*	Douglas-fir	New England, New York & Pennsylvania	Widespread wherever grown	Generally severe, variable.	No effective control known; hope of finding resistant strains.
Hypoderma	Red pine	Massachusetts (So. Hadley)	Very local	Slight	None.
	Pitch pine	Pennsylvania	Local (?)	Slight	None.
Unknown	White pine	Massachusetts	Local	Light (?)	None.
	Red spruce	Vermont (Green Mountain area)	Localized	Light to moderate (?)	None.

(continued)

Table 2.--(continued)

Disease	Host	Locality affected	Extent	Degree of infection or damage	Recommended control action
Nursery root rots and damping-off	Conifer nursery stock	Regionwide	General distribution, but variable with nursery locations	Variable, generally prevalent. Severe in certain nurseries.	Under investigation.
Strumella canker	Oaks	Regionwide	Widespread	Moderate	Salvage; destroy infected tree residues.
Nectria canker	Birch, maple, & other hardwoods	Regionwide	Widespread	Severe spot damage.	Eliminate affected trees in early thinning and during stand improvement; salvage useable timber.
Hypoxylon canker	Poplar & Aspen	Regionwide	Widespread	Moderate to severe.	Remove infected trees by thinning. Destroy infected material.
Bleeding canker (Phytophthora)	Sugar maple	New England States	Localized	Moderate to severe.	None effective.
Cytospora canker	Norway & ornamental spruces	New York & New England States	Generally widespread	Variable, usually moderate to severe.	Proper thinning; maintain good growth rate; spray ornamentals.

Beech-scale Nectria	Beech	New England States, New York and Pennsylvania	Widespread in New England, localized or spotty elsewhere.	Severe, increasing in southeastern New York State.	None known.
Black knot	Prunus sp.	Regionwide	Common & widespread	Moderate to severe	Sanitation; salvage of commercially important stem-cankered black cherry.
Canker-stain	Sycamore	Pennsylvania (Harrisburg) & W. Virginia (Pendleton County)	Localized	Severe on London plane, slight on native sycamores.	Avoid wounding; sterilize pruning tools; use toxic wound dressings.
Unidentified canker	Red spruce	W. Virginia (Monongahela National Forest)	Lozalized	Slight, scattered damage.	None.
	Varied and numerous hosts (see text)	Regionwide	Localized	Slight to minor damage.	None.
Fomes root rot	Conifer plantations	Regionwide	Widespread	Severe on red pine; moderate to slight on white pine; variable on other species.	None known; maintenance of rapid growth rate believed helpful; creosote freshly cut stumps in newly thinned stands when infection is absent.

(continued)

Table 2.--(continued)

Disease	Host	Locality affected	Extent	Degree of infection or damage	Recommended control action
Polyporus root rot	Conifers	New England States	Localized	Moderate to severe.	None.
Armillaria root rot	Conifers and hardwoods	Massachusetts, Vermont, New Hampshire, & West Virginia	Widespread	Variable; usually moderate.	Maintain tree vigor.
Steccherinum heart rot	Mostly sugar maple, few other hardwoods	New Hampshire & Massachusetts	Widespread but spotty	Abundant fruiting, moderate damage.	None, probably prompt painting of tree wounds helpful.
Fomes heart rot	Hardwoods	Regionwide	Widespread	More fruiting on living trees than usual.	None.
Red heart rot	Conifers, Norway spruce	Vermont & New York	Generally widespread	Accounted for 5-8% of cull in Vermont Norway spruce plantation.	Care and early pruning of small-sized branches.

Red ring rot	Conifers	Maryland	Localized	Common on logging-damaged loblolly pines.	Avoidance of tree damage and heartwood exposure.
Taphrina witches' broom	Mostly wild cherry	Regionwide	Widespread, somewhat spotty	Slight; less abundant than usual.	None.
Vaccinium witches' broom	Vaccinium - firs are alternate hosts	New Hampshire (southern); Massachusetts (north-central)	Localized	Very abundant in scattered spots; slight damage.	None.
Apiosporium witches' broom	Amelanchier sp.	New Hampshire (southern) Massachusetts (north-central)	Localized	Severe infection centers, no economic importance.	None.
Dwarf mistletoe	White and red spruce	Maine (coastal areas)	Localized	Moderate to severe.	None feasible.
Dutch elm disease	American elm	Regionwide	Widespread	Severe, increasing in importance.	Remove infected trees promptly; thorough sanitation by pruning dead wood and disposal of infested wood; spray to control insect vectors. (refer to special literature.)

(continued)

Table 2.--(continued)

Disease	Host	Locality affected	Extent	Degree of infection or damage	Recommended control action
Oak wilt	Oak species, especially in the red oak group	Maryland (centered in Allegany County, extending from Fairview Mountain, Washington County into Garrett County)	Infection centers in northwestern part of State	Severe and of great potential damage.	Infected areas treated by cutting, poisoning, and spraying stumps. Stumps poisoned with 2, 4,5-T within 50-foot radius. Frequent observations of 17 untreated sites set aside as study plots.
		Pennsylvania (mostly south-central and southwestern parts of State)	In 18 counties in 1959; 71 single infection, 232 group infections, and 102 breakover areas found and treated. Total infected areas treated was 405	Damage variable; greatest threat is its potential damage.	Removal of infected trees and others within 50-foot radius of nearest infection. Stumps poisoned.
		W. Virginia (general with heaviest infections in Northeast and Southwest portion of State)	Infections in 44 counties, not in 4 where found in previous years although disease found in 2 new counties; 2414 trees treated on the 1637 oak wilt centers found during 1959	Damage variable, ranging from light to severe. Actual total damage low, but potential damage great.	Deep girdle method of control used.

Mimosa wilt	Mimosa	Maryland (eastern shore)	Localized	Spot mortality	Replace with resistant varieties.
Verticillium & Cephalosporium wilt	Hardwoods, mainly elm and maple	Regionwide	Widespread	No specific reports	None.
Maple dieback	Maple	Pennsylvania, New York, New England States	Widespread	Serious, possible improvement.	None.
Ash dieback	Mainly white ash	Long Island to Rensselaer & west to Chautauqua County, New York	Widespread and spotty	Light to severe, concentration in Poughkeepsie area. Found in some forest areas.	None known; salvage.
Birch dieback	Birch	New Hampshire & Maine	Widespread	Serious, situation fairly stable in Maine.	Salvage.
Conifer dieback	Scotch pine	Cortland & Chenango Counties, New York	Localized	--	None.
Beech decline	Beech	New York (southern)	No information	Cause for concern.	None known; salvage.

(continued)

Table 2.--(continued)

Disease	Host	Locality affected	Extent	Degree of infection or damage	Recommended control action
Oak decline	Oaks, all species but red, scarlet, & black most affected.	Throughout region	Extensive	Variable with location; slight to serious; trend uncertain.	None; salvage.
Leaf scorch	Mostly hardwoods	Pennsylvania, New York, and New England	Localized	Generally slight; may be serious when associated with dieback.	None.
Dying of balsam fir	Balsam fir	Vermont & New Hampshire	Widespread	Spot mortality.	None practical.
Forking of white pine	White pine	New Hampshire & Maine	Spotty	Slight	None, cause unknown.
White pine needle blight	White pine	New York, New England & West Virginia	Several localities, scattered	Light, severe on W. Virginia affected trees.	None known.
Chlorosis	Norway pine	Maine (Woolwich)	Localized	Light	Corrected by application of 2 oz. of muriate of potash (60% K_2O) per tree just prior to growing season.

Salt damage	White pine and hemlock	New England States	Certain areas along roadsides	Moderate	None feasible; correct drainage to prevent accumulation.
	Loblolly pine	Maryland (southern)	Along salt marsh edges at high water	Slight to moderate	None.
Herbicide damage	Various	Massachusetts & Maine	Localized, spotty	Becoming more common.	Care in application of herbicides.
Animal damage: Mice	White pine, gooseberries, & privet	New York & Maine	Localized	Moderate, rather heavy last year.	None.
Birds - (Grosbeak)	Mostly Scotch & white pines	Maine, New Hampshire, Massachusetts & New York	Localized	Moderate (?)	None.
(sapsuckers)	Austrian pine & birches	Maine & Massachusetts	Localized	Limited and minor damage.	None.
Porcupines	Mostly conifers & poplars	New England States	Localized spots	Total damage moderate, sometimes extensive, has not been properly evaluated.	Control by controlling porcupines by poisoning, etc.
Deer	Young reproduction; hemlock	Reported from	Widespread	Extent of damage not evaluated.	None feasible; fencing used, but expensive.

(continued)

Table 2.--(continued)

Disease	Host	Locality affected	Extent	Degree of infection or damage	Recommended control action
Weather induced troubles:					
Winter kill	Exposed conifers, evergreens, & ornamentals	New England States, New York, & Pennsylvania	Widespread	Extensive killing & injury to exposed plants.	None feasible in most cases; ornamentals could have been winter protected.
Frost heaving	Nursery stock	New England States	Localized	Moderate damage to unmulched nursery stock.	Mulching and winter protection.
Top kill	European larch in nurseries	New Hampshire	Local	Late 1958 growth tender and unhardened, minor damage.	None.
Leaf scorch	Various hardwoods	Pennsylvania	Unknown	Minor damage during late August & September dry spell.	None.